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Editorial

Self help: The Prime Minister of India in his speech at Coimbatnre stressed on hard work by all sections of the people in fighting poverty and furthering the well being of India and that in the advancement of the country the people and Government should concert; neither alone could do much. This is specially true of agricultural workers on whom the production of food depends. Agriculture prospers the more the attention paid to it. Indifference and absentee landlordism are its worst enemies. Instances are forth coming where erstwhile barren or poor yielding land has been made highly fruitfull under careful, personal management and industry. The other side of the picture of land sliding back to barrenness through neglect is well known. It is very necessary that villages should be improved and made more attractive. This could be achieved with the willing co-operation of the villagers alone. The Community Projects initiated by the Government with the co-operation of the people could bring in the much needed relief and prosperity. The villages could be transformed. But, for these things to occur the villagers themselves should show their zeal and eagerness. They should develop an outlook in life of trying to help each other and themselves instead of waiting for or depanding upon a third person to do the work. Orderliness, cleanliness and improvement in health etc., could be brought about without much money being spent by the Government if only the villagers make up their minds. Elsewhere in this issue is given an account of how a people, not much depending on huge machinery have succeeded as one of the best agriculturists in the world through sheer industry and co-operation. It is this sort of self-help in all matters which will bring a community nearer to prosperity that the Prime Minister so much exhorted the people to follow.

The Andhra State: The Andra State has begun functioning under very auspicious circumstances, even nature became bountiful. It is pleasing to note that the Department of Agriculture in the new

State has started with a full complement of highly qualified and experienced personnel and research workers. Under their able guidance the department is sure to develop in all branches of agricultural activity and ere long take its place along with other older institutions to play a leading role in the advancement of agriculture in this predominantly agricultural country.

Weather: During this quarter there has been wide spread plentiful rains, not even the proverbial famine districts expected. The havoc done by floods here and there have not so much affected the crops in general, though some damage has occurred. With this bounty from Nature we hope that the agriculturists will return to their villages and once more lead the peaceful life to till the lands and engage themselves in the Nation's most important industry.

A Request

Subscriptions to the Madras Agricultural Journal should always be paid in advance. Subscribers who are in arrears to the Union are requested to clear their arrears. The rate of subscription for the Journal is Rs. 6/- per year.

Secretary,
M. A. S. Union.

Certain Aspects of Harvest in Relation to Crop Performance in Bendi (*Hibiscus esculentus* Linn).*

By

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The importance of bhendi (Gumbo or Okra) as an article of food and the wide range of conditions under which it may be grown have made it one of the most popular among the commercial and home garden vegetables of South India. The high yields coupled with the short span of life of this crop has made it not only remunerative but also one eminently suitable for entering into any one of several crop rotations. Numerous types of bhendi are under cultivation in Madras State and elsewhere but yet attempts to improve this useful vegetable crop have been surprisingly meagre as the literature reviewed later in this paper would show. The investigations dealt with in this paper represent one phase of the research on bhendi that is being carried out at the College Orchards, Coimbatore, and have for their main objectives the following:

(1) To work out the economics with special reference to the differences, if any, in the monetary returns obtained from a crop the produce from which is entirely picked for consumption as vegetable as compared to one whose produce is partly used for consumption and partly for seed, as well as to one whose seed is diverted wholly for purposes of seed collection.

(2) To study the physical characteristics such as weight, relative density, etc., of the seeds obtained from the several treatments, in order to judge whether differences, if any, in these attributes would have a determining influence on the crop raised from such seeds.

(3) To study the performance of the crops raised from seed lots that resulted from the several treatments under item (1) above, which represented three successive but distinct phases in the life of the seed crop.

Review of past work: The literature on this crop is not only sparse but is found to deal mainly either with the varietal and breeding aspects or on the general methods of cultivation, pests and

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diseases, etc. In Madras, Venkataramani (8) attempted a classification of 34 types based on the plant characters. He also made certain intervarietal crosses with a view to exploit hybrid vigour. Shanmugasundaram (5) has recently reported the results of an investigation on more or less similar lines to those reported in this paper and these have been discussed later in the course of this paper. It may be added here, however, that he does not describe the material he employed and more particularly whether he worked with a pure line, a factor of special significance in all field investigations undertaken with this vegetable. He has also made no mention of the rates at which the market value and the income obtained from his crops were calculated nor does he define the basis on which the 'quality' of the seeds was assessed nor, again, does he seem to have continued his trials to study the performance of the seeds obtained from the individual treatments.

Growing of crops for seed has long been recognised as an industry requiring skill and knowledge and has therefore received considerable attention from scientists as well as commercial seedsmen in regard to the more important vegetables. Green (2) observes that the practice of sowing seed from the plants remaining in the garden after the best specimens have been gathered for use as vegetable is a very poor one. He recommends that where seed is to be saved a few plants should be allowed to go to seed for this special purpose without being picked at all for vegetable. When it is desired to hasten the ripening period of a variety, he suggests that only the seed from the earliest maturing specimens should be planted and, on the other hand, to fix late maturing qualities, seeds should be saved from late maturing fruits on those plants which possess these features to the greatest extent. Thompson (6) dealing with lettuce suggests that the first seed produced by the plant might germinate better than seed developed during the later stages of the physiological development, i. e., when the plant reaches maturity.

The size or specific gravity of the seed is generally considered as another important factor having a bearing on crop performance. Seed separation by specific gravity has been in practice for over 30 years in western countries. Kieselbach and Helm (3) conclude that a higher individual plant yield is obtained from larger seeds than smaller ones. Thompson (6) observes that seed from later harvests was half as large as the seed from the first harvest. Cummings (1) found notable differences in numbers and sizes of marketable radishes produced from seeds selected and screened into different grades.

Schmidt (4) also found differences in size of radish plants following the same order as the difference in weight of seed planted. His experiments with soya bean showed that the plants from lighter seeds gained growth rapidly and overtook the plants from heavy seeds. In most cases it was found that the speed of germination was greatest with light seeds and seemed to decrease as the seed weight increased, the plants from heavier seeds being better in the seedling stage. The seeds of medium weight produced better plants from the stand point of several quantitative measurements than did the lighter or abnormally heavy seeds.

Materials and methods: An observational trial was first undertaken in 1951 by devoting roughly equivalent areas for the treatments that have been listed below. The data were suggestive that systematically laid out experiments are likely to lead to results of economic value and therefore such trials were designed on systematic lines in 1952—'53 and the main investigations were repeated over two cropping seasons as detailed below.

Bhendi seeds of Selection No. 7 (Plants medium in height, fruits 5–6 inches long, five-ribbed, green with light pink splash, yield medium to heavy, duration 100 days) of the College Orchard, Coimbatore provided the seed material. The trial was initiated in August, 1952, the first crop being sown in that month to consist of the following four treatments.

A. *Harvesting the entire crop of fruits at consumption stage:* This stage was fixed as when the fruits were in a 'snap' condition, about three to four inches long, seven days after petal fall, and fit for use as vegetable. The sale price of the fruits at this stage was fixed at Re. 0—2—0 per lb. to conform to the prevailing market rates at Coimbatore.

B. *Leaving the entire crop for seed:* The fruits were allowed to develop on the plants till full maturity and seeds from these fruits were collected. The stage of full maturity was decided on the signs of first dehiscence of the capsule at the distal end, the sale price of the seed was fixed at Re. 0—3—0 per ounce, which was the rate at which it was being sold at the College Orchard. No fruits were harvested for consumption at any stage.

C. Harvesting the crop from the first two 'trusses' on the plant for consumption and leaving the rest of the crop for seed, the income being worked out at the same rates as above.

D. Allowing the fruits from the first two 'trusses' on the plant for seed and picking the subsequent crop for consumption, the income being worked out as under C.

A randomized layout of plots was adopted with eight replications and with 20 plants for plot, the effective area of each plot being 6 ft. x 10 ft. The harvests under the various treatments extended from October to November, 1952.

In order to confirm whether the results obtained with the autumn crop were applicable to the summer crop as well, the trials were repeated during the summer season extending from February to May, 1953.

Presentation of data and results: I. The analysis of the data under the several treatments in terms of crop yields and monetary returns is set out below separately for the 1952 autumn and 1953 summer crops.

i. *Autumn crop:* August—November, 1952.

	A	B	C	D
(a) Mean yield per plot (60 sq. ft.) in number of fruits.	191	102	105	82
(b) Mean income per plot (pies) at Re. 0—2—0 per lb. of fruits and Re. 0—3—0 per ounce of seeds.	104	13	32	27
Significance by 'F' test (p = 0·05).	(a) Significant. (b) Significant.			
Critical difference.	(a) 26·8 (b) 22·9			
Conclusion:	(a) A	C	B	D
	(b) A	C	D	B

By both these standards, viz., yields of fruit and as monetary returns, the results show that it is best to leave the entire crop for fresh fruit harvests in as much as the margin of profit he derives thereby is nearly three to seven times larger than by the other treatments. No significant differences are apparent between the other treatments of either leaving the entire crop for seed or partly for seed and partly for vegetable.

ii. *Summer cropping:* February—May, 1953.

	A	B	C	D
(a) Mean yield per plot in number of fruits (60 sq. ft.)	142	63	72	102
(b) Mean income per plot in pies at Re. 0–2–0 per lb. of fruits and Re. 0–3–0 per ounce of seeds.	108	63	72	72
Significance by 'F' test (p = 0·05).	(a) Significant. (b) Significant.			
Critical difference.	(a) 33·3 (b) 11·2			
Conclusion.	(a) A	D	C	B
	(b) A	C	D	B

The results are seen to be in conformity to those obtained for the autumn cropping except that in the case of fruit yields, the treatment of picking of fruits for consumption after leaving the first two trusses for seed, has proved significantly superior to the treatments in which the entire crop and the late crop were left for seed. Incidentally, it may be mentioned that the periodical picking of fruits as vegetable has stimulated the plants to produce a larger number of fruits than the treatments in which a portion or all of the crop was diverted for seed purposes.

II. The specific gravities of the seeds collected under the treatments B, C and D were determined to be 1·04, 1·03 and 1·06 respectively, indicating thereby that the differences between the treatments in this regard were very slight indeed. This shows that the seed size and density in bhendi are not liable to variations such as have been met with in other vegetables crops like lettuce, radish, soya bean, etc., by other workers as detailed earlier.

III. Seeds obtained from the several treatments in the autumn trials were utilised for performance studies during the summer of 1953 the results of which are given below.

(a) *Germination of seeds:* The mean percentages of germination were 91, 93 and 95 for seeds from the treatments B, C and D, respectively.

(b) *Flowering:* The date of flowering of the plants raised from seeds obtained from the three treatments were recorded. The following table represents the frequency group of the plants according to the time taken to flower from sowing of the seed.

Total number of plants under observation for each treatment: 160.

	No. of plants that commenced flowering			Total	Remarks
	6 weeks after sowing	7 weeks after sowing	8 weeks after sowing		
B	58	74	12	144	Difference from the original nember of 160 are due to casualties.
C	68	70	6	144	
D	76	58	14	148	

Though there are certain differences in the figures between the treatments which are suggestive that seeds from early harvests have given a larger number of plants which have flowered within 6 weeks of sowing than those seeds which came from the later

harvests, the results cannot be deemed as conclusive. For one thing the differences are not very large; for another they need to be confirmed. There is also the fact that treatment B which comprises of mixed lot of seeds has given a relatively 'late dispersion' in the frequency group—a feature contrary to expectation and the reasons for which are not clear.

The analysis of the data on the yield performance of the crops raised from the seeds derived from the three treatments B, C and D is set out below:

	B	C	D	Mean
Mean yield in number of fruits per plot (6′ × 10′) ..	62	56	58	59
Significance by 'F' test (p = 0·05) ..	Not significant.			
Standard error: 5·0.				

The results show that there is no difference in the quality of the seeds obtained from a crop subjected to differential treatments in the harvest of the produce of the nature adopted in this investigation.

Discussion: The results of the first part of the investigation on the economics of harvesting adopting different methods conclusively prove that picking of bhendi as and when the fruits are ready for consumption as a vegetable is the most profitable means of disposal of the crop. The yields of fruit are also found to be proportionately high under this treatment, supporting the popular belief that regular harvests of the tender fruits before the seeds have developed to any extent stimulates further flowering and thereby indirectly assists in extending the bearing period. These results are in agreement with those reported by Shamugasundaram (5). Allowing even a few fruits to mature their seeds on the plant is believed to discourage the further flower and fruit production. The formation of mature seeds in the fruit marks the culmination of the life processes and points to the accomplishment of the biological purpose of the plant organism in the cycle of life and the natural impulse to produce flowers and seeds and thereby perpetuate the species is lost in an annual once seeds are produced and they have matured. It is therefore advantageous for vegetable growers to periodically and frequently gather the fruits in the tender stage not only to meet consumer preference but also to extend the fruit-bearing phase of the plant and obtain larger yields. It must be mentioned here that Shanmugasundaram (5) has concluded from his studies that picking of the fruits for vegetables more than on ten occasions spaced out during the progress of the crop definitely lowers

the number of seed producing fruits which would become available thereafter and consequently the total revenue from such a dual purpose crop would be diminished,—a conclusion which seems to indirectly suggest that provided fruits for vegetable are harvested on a restricted basis, the system of allowing the same crop for vegetable and seed purposes is in fact remunerative. Allowing the crop entirely for seed purposes exposes the plants to ravages of pests and diseases of which there are not a few on bendhi and all of which are very destructive in their effects. This feature coupled with the inadequate 'Impulse' to continue flowering in the absence of periodical harvests, appears to be responsible for the low monetary returns from a crop devoted entirely for seed purposes. Green (2), however, considers this to be a better practice than the other treatments where the first few harvests are made for vegetable prior to leaving the crop for seed on considerations which have not been confirmed in the present investigations. The advisability of collecting the 'early' and 'late' formed seeds as far as the monetary aspect is concerned has been proved to be a point of minor significance. It must, however, be mentioned that by an undue extension of the cropping period the incidence of pests and diseases as well as of the virus which is so common on the bhendi is likely to be intensified. Seed collection from such a crop being out of question or at any rate inadvisable, it may be worthwhile for individual growers to set apart a portion of their crop for seed extraction alone and confine seed collection to only these first formed fruits before the crop has advanced very far.

The data on specific gravity of the seeds obtained under the several treatments are suggestive that in so far as the bhendi is concerned this attribute appears to be more or less a varietal character which is not susceptible to fluctuations due to deviations in cultural details such as of harvesting. This is an advantage to the bhendi grower in that he does not have to take special care and precautions to sort his seed into several grades such as heavy and light, or large and small, etc., which, as has been brought out by the investigations of Cummings (1) and Schmidt (4) have a definite influence on cropping in such vegetables as the radish and soya bean.

From the observations of the plants raised from the three groups of seeds, it is seen that the belief that seeds collected from early harvested fruits shorten the duration of the suceeding crop and that seeds from the late harvested fruits lead to its prolongation is not true for the bhendi crop. On the other hand, the duration of

the crop in this vegetable appears to be a varietal character that cannot be influenced one way or the other by a mere change in a cultural detail such as late or early harvests of fruits intended for seed. While this no doubt eliminates the need for watching and distinguishing the particular fruits from which the seed produce has to be gathered, it must be mentioned that a wise cultivator should not normally wait till the fag end of the season for gathering his seeds when the crop is on the decline. It is good plant husbandry on the other hand to adopt the conventional method of harvesting a crop for seed in its prime from selected, typical and promising plants in the available population.

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Snails Damage to Paddy in the Northern Circars and their Control

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Introduction: There were reports of snails damaging paddy crop even earlier than 1917 (14) in South India, but the studies regarding nature and extent of damage, conditions that favour the pest and the possible remedies were taken up only in 1936 (Cherian and Krishnamurthy (3). It was the report made from Kashmir about the occurrence of snails as a pest of cultivated crops in the second Entomological Meeting at Pusa in 1917 that drew the attention of the Entomologists in India and Burma to this non-insect pest of crops (14). A positive case of snails eating up paddy seeds which were sown, necessitating their collection and destruction, before sowings could be taken up for successful cultivation of paddy crop, was reported by Shroff in the third Entomological Meeting held at Pusa in 1919 (15). Since 1936 attempfs were made to take up control measures for reports received of severe damage to paddy by snails in the Madras State but the problem continued to remain unsolved till a satisfactory remedy was available through use of BHC in 1951.

Review of Literature: The question of possible damage to cultivated crops by snails was discussed in the Second Entomological Meeting held at Pusa (Bihar, India) in 1917. The occurrence of Apus cancriformis in Kashmir at an elevation of 6,000 feet and damaging paddy crop was brought to light then. Shroff K. D. (15) dealt with the subject of field snail (*Ampullaria* sp.) which is a pest in Burma for paddy crop eating away the seed sown. Basinger (1) discussed the question of use of poison baiting against snails—*Helix aspira and H. pisana.* Queensland Agricultural Journal (11) suggested the use of lime and soot to keep away slugs and snails. Agricultural and Fisheries leaflets No. 115 (10) deals with the subject of slugs and snails and their damage to cultivated crops. The subject of snail damage to paddy crop in South India was investigated in 1936 and the results were published by Cherian and

Krishnamurthy (5 & 3). Jary (6) refers to the contact action of methaldehyde on slugs and snails. Ramakrishna Ayyar (13) makes mention of slugs and snails under non-insect pests of crops like paddy, betel vine and aloes. Queensland Agrl. Journal (12) refers to slugs and snails as well known pests of gardens and seed beds. Lange and Macleod (8) recommend the use of various baits. Agricultural Gazette (16) deals with the food plants of the non-insect pests and their control through mechanical and baiting methods. Cotton (4) reports that there are over a hundred snails in Australia, each kind inhabiting only a particular geographical area and that elevation, humidity and types of soil define the distribution of any species. Joubert and Walters (7) state that snails and slugs have become troublesome, feeding on large number of garden plants as well as agricultural crops and pastures.

The occurrence of snails in the Northern Circars: The reports of damage to cultivated crops by snails concern only paddy as far as Northern Circars are concerned. The senior author had come across snails feeding on coriander, fenugreek, pasture grasses and cruciferous vegetables grown in plains of circars. The damage in these cases was only sporadic and incidental and did not warrant the application of any remedial measures. Reports of damage to paddy are often received from Krishna and Guntur districts in the low lying paddy regions whether they are in the coastal belts or in the interior. The pest is felt more during years of early break of South-west Monsoon and the resultant early season for paddy planting. Kaikalur, Gudivada, Bandar and Gannavaram taluks in Krishna district and Bapatla and Repalle taluks in Guntur district were the areas that reported this non-insect pest of paddy so far in the North region of the State.

Species of snails affecting paddy: Cherian and Krishnamurthy (3) while investigating the problem of snail pest on paddy in Krishna and Guntur districts recorded four species; (1) *Viriparus variatus*, Frawengled. (2) *Pila vireus*, Lamarck. (3) *Indoplanorbis exustus*, Deshayar and (4) *Limnae acuminata*, Lamarck. Of these the first mentioned is found in large numbers in all the areas, the second and third in smaller numbers than the first. The last one was said to have been collected as *of rare occurrence* but our recent collection of snails from affected paddy areas did not show this species.

Nature of attack and extent of damage: Snails, besides the damage to paddy seeds sown in the nursery beds and the seedlings

there, attack the newly transplanted crop. As far as the delta districts in the Northern Circars are concerned, the damage to paddy seed beds by nibbling the seed sown or attacking growing seedlings is not of sufficient significance so far and can be ignored but the real damage is to the paddy transplanted. The newly planted seedlings are cut at the stem as a result of which the top portions of plants cut off, float in numbers in the water standing in the paddy plots. The cutting of the stem is a slow-process about two to three hours being taken to cut through a stem of $\frac{1}{3}''$ in thickness by each snail with its delicate mouth parts. The snails feed by rasping and chewing the foliage. The transplants are generally cut 3" to 4" from the base below the surface of water in the field. The cut ends exhibit an irregularly serrated surface. A few crabs may also be seen along with a large number of snails in the fields but their damage, where snails predominate, is limited. The crab gives a sharp cut to stem or leaf blade whereas the cut by snails is of lacerated nature. These molluscs are active during nights getting on to the plants after dusk and the presence of water in the field facilitates their movement from place to place in the field and from plant to plant where paddy is given wide spacing in the transplantation. In the absence of water the snails can be found stuck up in the puddle by the weight of their shell. In fields where water can be drained the pest can be thinned heavily by this agricultural method, to secure a natural check for the pest. In every paddy growing tract we come across some low-lying areas where the fields cannot be drained and though the irrigation water can be taken out to some extent it cannot be continued to obtain conditions as to secure the exposure of paddy puddle either to prevent the movements of molluscs or subject them to the effect of sun. Consequently the snail damage continues to be a problem for such areas.

It was estimated that in low-lying fields where snails continue to be a problem anywhere from 10 to 50 per cent of the seedlings planted can be cut down and the stubbles made to rot. The damage is confined to a short period of about a week after planting till the third week for a period of about a fortnight. If the paddy gets protection during this period, the crop can defy snails and they *cease to affect the crop as a pest.* When the planted seedlings are cut down in patches they are to be replanted since the ryot knows that the stubble left in the field cannot revive under the stagnant condition of low lying areas but die and rot in due course. The replanting necessitates the purchase of seedlings and planting in the affected patches with additional

labour. All these are worked out to a cost at Rs. 0—8—0 for every cent of area affected. If half of the field working out to 50%, is affected the extra charge for the purchase of seedlings and labour for planting can be taken as Rs. 25/-. The real loss to the ryot is not so much in this as the loss in yield consequent to the late planting of the crop obtained in the affected patches. In the low-lying areas any delay in planting is dangerous as any inundation of the fields by an advancing monsoon badly affects a young transplanted crop and the attempt in such areas is always to secure as early a planting as possible for the paddy crop, so that it can establish itself well and begin to grow before heavy rains set in and inundate these low lying fields. The average loss on account of snails in such areas is estimated at 20 per cent of the crop. A field giving a yield of 10 to 20 bags may lose 2 to 4 bags of paddy per acre costing Rs. 40/- to 80/- and with the expenditure for replanting added the loss commuted to money value, may be from Rs. 50 to Rs. 100 per acre with the present high prices for paddy. The delta ryot at paddy cultivation is intelligent and calculative and knowing the loss he is facing he had been pressing the Agricultural Department for a positive remedy all these years and was not satisfied with the replanting of the crop to which he was resorting hitherto as an indirect remedy for the pest.

Remedial measuras adopted by other workers: The remedial measures tried and advocated by other workers are dealt with below:

Mechanical measures: 1. In Burma the cultivators collect and throw them into creeks before they start sowing. However, it has to be done twice or even thrice in badly infested fields (Shroff (15). 2. Minist. of Agri Egypt, (10) advocates trapping with boiled potatoes, orange skins, chopped clover leaves, bran or lettuce. 3. Ramakrishna Iyer, (13)–recommends hand picking. 4. Queensland Agri. Journal (12)–recommends attracting the pest to boards of large cabbage leaves placed on the ground, systematic collection and destruction of the pests. 5. Joubert and Walters (7) suggest hand collection or use of fire against the pest wherever possible.

Chemical method: A. *Poison baiting:* 1. Basinger (1) advocates mixing 1 part of calcium arsenate with 16 parts of bran and enough water to just moisten the mixture. The bait is broadcasted in the field. He says that the result from an application should not be judged until two or three days later. 2. Jary (6) recommends 1% metoldehyde in bran kept in heaps and protected from rain. 3. Ramakrishna Iyer (13) recommends Meta bran bait 3 tablets of meta on 1 lb. bran (dry) and moistening the product with half a cup of water. The bait is distributed over the more heavily infested areas either broadcast or in small heaps-one tea spoonful at two feet intervals. 5. Lang and MacLeed (8) found the most satisfactory mixture to be 1·5—2·5% powdered metaldehyde and 5% calcium arsenate with several other ingredients such has bran, fruit pulp, boiled potatoes or molasses. Calcium arsenate, 1 lb. to 16 lb. of bran was less satisfactory than meta bait. Meta plus wheat bran bait gave a good kill but was less effective than the bait with

the addition of calcium arsenate especially under humid conditions. They recommended the following baits:

(a)	Calcium arsenate	... 1 lb.	(b)	Resins	.. 46·25%
	Meta	.. 0·5 lb.		Bran	.. 46·25 ,,
	Bran	.. 16 lb.		Meta	.. 2·50 ,,
	Water	.. 2 gallons.		Calcium arsenate	.. 5·00 ,,
	Black strap molasses	.. 1 pint.			

6. Joubert and Walters (7) bran–25 lb. Calcium arsenate–2 lb. molasses–¾ gallon and water 1 gallon.

B. *Contact poisons*: Queensland Agricultural Journal (11) records that watering with alum kills slugs and snails.

C. *Deterrents:* Minist. of Agricultural & Fisheries, Egypt (9) records that copper sulphate has proved very effective as a dust as well as solution but it cannot be used among green plants as it scorches them. He advocates the use of Bordeaux mixture as a protective dressing. 2. Queensland Agricultural Journal (11) recommends lime, soot, coke, ashes and salt to keep away slugs and snails.

D. *Biological:* Minist. of Agriculture & Fisheries, Egypt (9) has recorded birds, frogs, and toads as the natural enemies but no method of encouraging any of them was recommended. 2. Joubertand Walters (7) recommend the use of poultry.

Discussion: It can be seen from the above that biological method could not be pressed into service for the control of snails anywhere and that only mechanical measures could be used for occurrences of the pest on a limited scale. In chemical control deterrents are of some use but no useful contact insecticide that does not adversely affect plants was available. Reliance was, however, put more on poison baiting. Amongst the poisons that were used in baiting, metaldehyde found favour. Fruit pulps, boiled potatoes and molasses are recorded by Lange and Macleod (8) as the attracts that can go well with a bran bait. The same authors state that the addition of 5% calcium arsenate to the metaldehyde improves its efficiency.

Trial of control methods for paddy snail in Krishna and Guntur Districts:
I. *Mechanical measures:* It was not possible to organise any of the mechanical measures since the snails come out to infest the paddy field only when it attains a puddled condition and it is very difficult then to go about the fields and resort to the laborious method of hand picking in the puddle. Further, where fields get their irrigational supplies through gravitational flow there is always the trouble of the pest from the untreated areas drifting to the fields treated and vitiating the results.

II. *Deterrents:* Deterrents can only be of limited use for keeping off the pest in small areas. Though there may be benefit to individuals the total effect of deterrents for the area is doubtful

for crops like paddy grown in contiguous areas. There is also the difficulty of application of a deterrent and its maintenance in paddy fields planted in puddle.

III. *Poision baiting:* Metaldehyde baiting: Bran bait with 2% metaldehyde was prepared and kept on paddy field bunds in small lumps at distances of two feet intervals. This was attracting the snails near by and those getting at the bait were found killed. Still there were, however, very many in the field itself moving from plant to plant in standing water of the field and they were not getting attracted to any of the baits kept on the bunds alround with the result that it was allowing a large number of escapes to continue their depredations. With a view to tackle the snails remaining in the fields the baits were put on plantain leaves and other floats to cover the field with about 2' interval between float and float. These floats unless tied to plants could not be maintained in their respective places to cover the whole field and be near at hand to any snail venturing into the plot and this measure increased the labour required for baiting considerably. In baiting it is necessary to secure an even distribution in the area to be rid of the pest and this was not possible in paddy fields. Therefore effective baiting is not possible and practicable in paddy grown in puddle.

Introduction of Benzene hexachloride (BHC) dusting as a remedy for the paddy snail: Having secured no advantage with metaldehyde for snails in paddy fields BHC, was tried. Water was drained outto the possible extent from the plots over-run with snails in Gannavaram taluk of Krishna district in July 1951 and the plots were treated with an average of 25 lb. of BHC 5% dust per acre. The results obtained were better than expected and snails were found dead in large numbers. The transplants were left untouched by this non-insect pest following the application of BHC. In all our trials one application was enough. Where rains interfere we may have to give a replacement dust. The cost of dust and dusting works out at Rs. 6/- per acre without any concessional sale for the pesticide and from the estimated loss worked out in para 5 *supra* it can be seen that the BHC treatment for snails in a paddy crop secures a gain of Rs. 44/- to Rs. 94/- per acre. That there is a real gain to the ryot could be testified from the number of ryots resorting to the treatment immediately after seeing the results in our test plots. In Gannavaram area it was estimated that the measure was pressed into service over a total of 100 acres in 1951 itself. The results obtained were immediately taken advantage of by

the paddy growers in Repalle taluk and a similar area obtained the benefit of BHC treatment. There is no published record of BHC having been used for control of snails. An appreciation of BHC treatment for control of snail damage to paddy crop was published in the Grow More Food Journal of the Department (Padi Pantalu—October 1951 issue—page 14) by a leading ryot Sri Chennupalli Nagendra Rao of Chennuvaripalem, Repalle taluk, Guntur district. It may also be added that a problem which started in 1917 had to wait for the advent of BHC for successful solution in 1951, after a period of over three decades.

Summary: Snails occur as a bad pest of paddy in low lying wet lands in Krishna and Guntur districts and inflict a loss of Rs. 100/- per acre. Draining the affected fields to expose the puddle is the local agricultural remedy but cannot be made use of for low lying areas. Baiting with Metaldehyde 2% in bran was tried with no useful results. Draining out water to the possible extent from the fields reporting this non-insect pest and dusting BHC 5% at the rate of 25 lbs. per acre costing Rs. 6/-. killed most of the snails in the field and brought the required relief to the crop. This measure secures a saving of Rs. 44/- to Rs. 94/- per acre to the paddy cultivator and has already become popular in the districts.

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Studies in Germination of Wild-indigo Seeds

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Introduction: Wild indigo or *kolinji* (*Tephrosia purpurea*) has a special significance as a green manure crop for paddy, since it is not grazed by cattle and is drought resistant. It has its defects, viz., it cannot thrive in soils where there is excessive moisture, its leaves easily shed, the yield of green matter is poor and worst of all the failure of germination of the seeds sown.

In order to understand, if, at any stage of seed development or under any special treatment, the seeds of *kolinji* could give a higher germination than that secured for mature seeds under normal conditions, a detailed study of the morphology and habit incidental to and affecting the germination of the seeds was made commencing from the early stage of seed development till when full maturity was reached. The studies were confined to immature and mature seeds.

Immature Seed: To obtain some idea of the progressive development of the growing seed, measurements were taken for size of seed at intervals of three days commencing from 15 days after the flower opening and continued till after full maturity was reached. The seeds were fully sun-dried after each time the measurements were taken and the measurements of the dried seeds were also

recorded. The average measurements of 5 seeds thus recorded are given in table 1.

TABLE I

Average size measurements of the growing seed
Date of flowering 3—3—1952

Date of measurement	Description	Length (m. m.)	Breadth (m. m.)	Thickness (m. m.)
18—3—'52	Fresh seed	4·0	2·8	1·7
	Dried seed	2·7	1·7	1·1
21—3—'52	Fresh seed	5·1	3·1	2·1
	Dried seed	4·2	2·3	1·4
24—3—'52	Fresh seed	5·1	3·2	2·3
	Dried seed	3·9	2·3	1·5
27—3—'52	Fresh seed	5·1	2·9	2·2
	Dried seed	3·7	2·3	1·5
30—3—'52	Fresh seed	3·7	2·5	2·0
	Dried seed	3·7	2·3	1·9
2—4—'52	Fresh seed	3·4	2 3	1·8
	Dried seed	3·4	2·2	1·7

It is observed that the seeds are quite immature and the pods quite green till after 3 weeks from the flower opening. Thereafter, a slight shrinkage of the seeds sets in and there is considerable reduction in the size of the seed in about 27 days when the pods are practically dry. The seeds are completely mature and dry when 30 days old.

Viability: In many cases seeds have to be after-ripened before they would germinate, in other words, there is dormancy. Work that has been done with immature seeds of certain plants (Goff, 1900) showed that seeds of many plants whose mature seeds exhibit dormancy, if removed before they are fully mature germinated at once. In order to find out if immature seed of *kolinji* germinated better than mature seed and if so, at what stage of its development the germination commenced, flowers were marked in different *kolinji* plants at different periods of flowering in three batches commencing from 18—2—'52 and ending with 29—2—1952. The germination test for the seeds was commenced after 15 days from the time of flower opening and carried out for a fortnight at intervals of 3 days. Each of these trials was conducted in three sets. The first set was tried immediately after the seeds were removed from the pods. The second set was tried after the seeds were fully dried and the third similarly as in the second one but after a resting period of 10 days from full dryage. The results of these trials with other details are given in table 2.

TABLE II

Percentage germination of immature seed at different ages and under different treatments

BATCH I				BATCH II				BATCH III			
Date of flowering	18—2—1952			Date of testing	25—2—1952			Date of flowering	29—2—1952		
Date of testing germination	Number of seeds tested* and % germination			Date of testing germination	Number of seeds tested and % germination			Date of testing germination	Number of seeds tested and % germination		
	1	2	3		1	2	3		1	2	3
4—3—1952	No: 14	12	10	11—3—1952	12	10	10	15—3—1952	18	12	19
	%: 0	0	0		0	0	0		0	0	0
7—3—1952	No: 13	14	14	14—3—1952	14	15	14	18—3—1952	12	12	12
	%: 15	49	0		14	7	0		0	0	0
10—3—1952	No: 15	12	20	17—3—1952	13	9	13	21—3—1952	13	11	16
	%: 0	0	0		40	33	0		62	45	0
13—3—1952	No: 10	5	3	20—3—1952	13	10	11	24—3—1952	12	9	9
	%: 0	0	33		31	0	0		92	55	77
16—3—1952	No: 10	11	16	23—3—1952	11	5	5	27—3—1952	10	5	5
	%: 50	36	38		63	80	28		40	100	60

*1. Fresh seed; 2. Dried seed; 3. 10 days after dryage.

It will be seen from the above table that the immature seeds started germination 18 days after flower opening. The germination might have commenced even a day or two earlier but under no event until after 15 days from the flower opening. There is appreciable increase in the germination in seeds 3 weeks old to 24 days old (62 and 92% resp.). Beyond the latter age in general, dryage of seed seems to improve viability, giving 80 to 100% viability for 27 days dried seeds. Resting the mature or the dried immature seed does not seem to improve the viability of either.

Mature seed: Detailed studies were made of seeds separated from individual mature pods collected from single plants. Seeds of small, medium and large size are met with, some times, in the same pod although it is common to find seeds of the same occurring together in the same pod. Irrespective of size, the seeds are found to be either hard or soft. Out of a total number of 24 plants examined at random, only one plant gave hard seeds. There were both soft and hard seeds in this plant and the former occurred either alone or along with the latter in the same pod. Mixed or alone, the hard seeds invariably are of small size. Table 3 gives the proportions of hard and soft seeds recorded in the above plant pod-war. Out of 49 mature seeds collected from these pods the hard seeds numbered 44, the rest being soft seeds.

TABLE 3.

Pod-war distribution of soft and hard seeds in a single plant.

Serial number of pods	Soft seeds	Hard seeds
1	Nil	3
2	3	4
3	1	3
4	Nil	6
5	1	3
6	Nil	4
7	Nil	4
8	1	3
9	Nil	4
10	Nil	2
11	Nil	2
12	Nil	6

In a bulk collection of seeds, the hard seeds are invariably fewer than the soft ones since the plants producing these are much fewer in number. The simple method employed to distinguish the hard seeds from the soft ones consisted in soaking the bulk seeds in water and separating the swollen seeds the next day from the hard non-swollen ones. As a rule, the hard seeds do not germinate immediately. Both the endosperm and the seed coat of a hard seed, as the very name suggests, are hard, unlike the normal readily germinating seed whose endosperm and seed coat are soft. The hard seed, with very few exceptions, is small and cylindrical although there may be seeds of similar size and shape that are soft and readily germinating. The small seeds, hard or soft,

when swollen assume the typical kidney shape of a normal big-sized seed. The average lengths of small, medium and big seeds are 3·5 mm., 3·6 mm. and 4·7 mm. respectively, average breadths 1·8 mm., 2·3 mm and 2·5 mm. respectively and average depths 1·8 mm., 1·8 mm. and 2·0 mm. respectively.

Viability: The time taken for the hard seeds to germinate varies from seed to seed. It might vary from anything like a few days to a few months. Table 4 gives the germination frequency of hard and soft seeds occurring together or alone in single pods collected from the single plant referred to above.

TABLE IV

Frequency distribution of germination of soft and hard seeds collected pod-war from a single plant.

Seed collected 19–5–1952.
Soaked 24–6–1952.
Kept for germination 25–6–1952.

Serial Number of pod.	1	2		3			4			5			6	7		8			9	10	11	12
Number of seeds in a pod.	3 Hard	2 Soft	4 H	1 S	3 H	6 H	1 S	3 H	4 H	4 H	1 S	3 H	4 H	2 H	6 H							
Dates of sprouting.																						
26–6–1952	..	2	..	1	1	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..
27–6–1952	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1		
28–6–1952	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	1		
29–6–1952	..	..	..	..	1	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..		
30–6–1952	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..		
3–7–1952	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..		
4–7–1952	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..			
7–7–1952	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..			
8–7–1952	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1			
11–7–1952	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..			
12–7–1952	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..			
15–7–1952	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..		
17–7–1952	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..			
21–7–1952	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	1	..	..			
23–7–1952	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..			
26–7–1952	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..			
27–7–1952	..	..	1	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..			
4–8–1952	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..			
11–8–1952	1	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..			
14–8–1952	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	1	..	..			
16–8–1952	..	..	..	..	..	1	..	..	..	..	..	1	..	..	..	..	..	..	..			
3–9–1952	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	1			
13–10–1952	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..			
18–10–1952	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..			
2–11–1952	1	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	2			
4–11–1952	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..			
5–11–1952	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..			

Mechanism causing failure of germination of hard seeds: It was thought the hard seeds did not germinate immediately on account

of their dormancy. A few seeds were dissected and the embryos removed and kept in Tukey's general purpose medium (Uttaman, 1949). The embryos readily germinated. This proved that the seeds failed to germinate immediately not on account of dormancy but due to some other cause. The failure of immediate sprouting of *kolinji* seed has been generally attributed to the hardness of its seed coat and endosperm. In fact the Madras Agricultural Department has advocated several methods to improve the germination of *kolinji* seeds and these include hand pounding to partially break the seed coat or treating the seed with hot water or dilute sulphuric acid to soften the seed coat. It has already been mentioned above that the period taken by the individual hard seeds to germinate varies considerably. It was therefore, thought that these variations in the period of germination, perhaps depended upon the variations in the hardness of the seed coat and a rough and ready method to gauge the relative hardness of the different seeds consisted in pricking the seed coat with the sharp point of a needle. A few seeds picked for this purpose at random from among a collection of hard seeds lying over in the germination tray without sprouting for over 20 days were subjected to this test. The pricked seeds without any exception swelled in contact with moisture within a very short time preparatory to sprouting. It was, however, felt that the hardness of the seeds did not materially differ from seed to seed so much as to warrant such wide and conspicuous variations in their periods of germination. These seeds were, therefore, subjected to a closer examination under the microscope. It was observed that the seed coats of the swollen seeds had not contracted a bruise or even a scratch. It was also observed that these hard seeds without any exception had on their surface a thick layer of wax which was sometimes, 4–5 times thicker than that ordinarily met with on the seed coat of a normal seed. The needle pricks registered on many of the swollen seeds did not extend in depth to more than the thickness of their wax coats and therefore did not injure the seed coat in any manner. It was thus apparent that this wax layer on the hard seed coat resisted the ingress of moisture and was really responsible for the failure of seed germination. This was later confirmed by direct test. A few hard seeds were placed under a dissection microscope and their wax coat carefully filed off in minute patches. Seeds whose wax layer was thus carefully rubbed off to an extent covering not even a pin head without injuring the seed coat swelled in contact with moisture within two hours

although their seed coats and endosperm remained as hard as ever immediately before keeping in contact with moisture. The softening of the seed coat and endosperm takes place in a suprisingly short period as soon as moisture gains access to the seed coat. An examination of the hard seed that has just swollen in the normal course after long periods of successful withstanding of moisture, clearly indicates several breaches in the protective wax layer upon their seed coats.

Discussion: In the experimental studies detailed above, it has been pointed out that the soft or normal seed readily germinates in the presence of moisture. Neither has it any resting period. Ordinarily the *kolinji* crop grown for green manure in the single crop lands of Malabar bears abundant pods towards June–July. The dry pods dehisce and shed seeds and as the land is prepared for planting paddy in July all the soft seeds, sprouted as well as non-sprouted, get totally destroyed. Later, after the harvest of paddy the lands are immediately ploughed and left fallow and with the subsequent showers a good many self-sown *kolinji* plants make their appearance. Evidently this crop must have sprung from the hard seeds that had remained viable in the soil under the protection of their thick wax coats. In the laboratory studies outlined above (Table 4) the few hard seeds of *kolinji* remaining healthy and fresh without sprouting in the germination tray sprouted during the first week of November after completing 131 days from the time of keeping for germination.

The facts that the immature seeds of *kolinji* germinated even when quite green and that the embryos of hard seeds readily germinated when kept in a culture medium would indicate that the failure of germination of the *kolinji* seeds is due neither to immaturity nor to dormancy of seed. From the experimental evidences adduced in the present studies it becomes clear that the hard seed fails to sprout immediately due to the failure of moisture to reach its seed coat at once on account of its thick wax layer which is partially impermeable to moisture. The variability in the time taken for the sprouting of the hard seed may, therefore, be due to the variations in the permeability of water through the wax coat depending on the differences in the water solubility as well as in the thickness of the wax layer. The usual idea that the failure of the seed to germinate is due to its hard seed coat and endosperm is in a way erroneous. The action, therefore of the treatments advocated by the Department to improve the

germination capacity of the *kolinji* seeds, evidently, consists in the dissolution of the wax coat on the hard seeds.

Conclusion: It has been observed that the hard seeds appear in much larger proportions than the soft seeds in a single plant and that these present all gradations from a very short to a very long range in the time taken for germination, the seeds taking the longest time for germination occurring in the smallest proportion (Table 4). This suggests the existence of a set of multiple factors affecting the quality or quantity or both of the wax layer upon these seeds. It should be possible to breed pure lines for hard seeds that do not sprout immediately and also for readily germinating seeds. Breeding a pure line for hard seed should prove highly beneficial to the ryot as this would save him a large amount of money and labour involved in the collection and storage, year after year, of large quantities of *kolinji* seeds for sowing in his lands for green manure purpose.

Summary: 1. Germination tests made on immature and mature seeds of *kolinji* showed that immature seeds started germination when the seeds were 18 days old. There is considerable increase in the germination when the seeds grew older. Drying of seed improves the viability when the seeds are 24 days or more old but not earlier. Resting the mature seeds or the dried immature seed does not seem to improve viability of either.

2. Study of mature seeds shows the existence of two kinds of seeds, soft and hard, the latter occurring in larger proportions compared to the former in the collections made from a single plant. Both the kinds appear either singly or together in the same pod.

3. The failure of germination of *kolinji* seeds is due to a thick wax layer upon the seed and not due to hardness of the seed coat. The variability in the time taken for the sprouting of hard seeds appears to be due to variations in the degree of permeability of moisture through the wax layer to reach the seed coat, which again is possibly dependent on the solubility in water as well as on the thickness of the wax layer.

4. The hard seed accounts for the self-sown crop of *kolinji* appearing after the harvest of paddy in the single crop lands in which a crop wild indigo was ploughed in earlier preparatory to growing paddy.

5. The possibility of breeding pure lines for hard seed that does not germinate over long periods and also for readily germinating soft seeds is envisaged.

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Studies on the Storage of Fishmeal in Sealed Tins *

By

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Introduction: The importance of fishmeal in the nutrition of cattle and poultry has been stressed by Chari and Pai (1948), and Chari (1948). Since large numbers of shoaling fishes occur on the West Coast of India, and as all the fish cannot be transported in fresh condition or salted, a good scope exists for a fish meal industry. Some of the fishes like the caranx, sharks, rays, silver-bellies and soles which appear in abundance could be converted into fishmeal and used to feed cattle and poultry. The industry being seasonal, the problem of storage presents difficulties especially on the West Coast with its high humidity and long monsoon period. Chari and Pai (1948) have stated that fish meal can be stored for several months in sealed tins but no chemical or bacteriological tests were done by them to support this statement. Hence the present investigation was undertaken to study the chemical and bacteriological aspects of storage of fish meal in sealed tins and in nitrogen gas.

Material and Methods: Clean, dry, sterile one gallon tins were packed with fishmeal and sealed. In another set into similarly filled tins, nitrogen was passed from a cylinder and then sealed at once so that most of the air was displaced by nitrogen. The tins were

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stored at room temperature, 29 to 32°C. An initial analysis was done before sealing the tins, for moisture, protein, sodium chloride, fat, acid value, total volatile bases and bacterial count. One tin in each set was opened every month, for analysis and observation. Before opening, the area to be pierced was sterilized by applying alcohol and flaming and an opening was made by a sharp sterile tin-cutter. Samples were taken out by a long sterile core sampler, which brought out a representative sample from all depths, for bacterial counts, T. V. B. etc.

The T. V. B. was estimated by the Conway technique, proteins, moisture, sodium chloride and fat were estimated by the A. O. A. C. (1945) methods and acid value as described by Hilditch.

Results and Discussion: The initial values of the chemical analysis and bacterial counts and also the data of periodical analysis are presented in Table I.

The moisture did not change appreciably in either the nitrogen-packed or air packed tins. The fat was gradually decreasing but much more in air-packed than in nitrogen-packed tins. Conversely in both cases there was a corresponding gradual increase of free fatty acids (acid value) parallel to the decrease in fat. The decrease in fat is explained by the cleavage of fats into fatty acids. These results conform to the observations of Whitmore et al (1948) who found that the acid value gradually increased in dehydrated pork and beef packed in cans with and without nitrogen gas and that there was practically no difference between the two packs.

The bacterial count does not appreciably change till the second month but in the third month there is a sudden increase which is fairly constant till the fifth month, from which period there is a fall in the count. The values for T. V. B. gradually increase till the fifth month, paralleling the increase in bacterial counts but after the fifth month there is a fall in T. V. B. also.

Organoleptic tests showed that after the fourth month a smell of ammonia was discernible which explains the high figures for T. V. B. After the fourth month the air-packed sample became brown while the nitrogen-packed one was less so. In the latter oxidation of fat was reduced.

Hay and Pearce (1946) found that packing eggs in carbon-di-oxide, nitrogen and in vacuo had a slightly beneficial effect. Likewise, Whitmore et al (1948) found that dehydrated beef and pork will remain edible for six months packed in air, in nitrogen or

vacuum at 135°F or for one year at room temperature. They also found that the moisture content of the samples packed in cans was practically unchanged after 40 weeks. Our values agree with these findings.

Moran and Smith (1932) and Tomkins (1932) studied the inhibitive effect of carbondioxide on meat attacking fungi but its action was not explained. In our experiments we did not find any mould growth on the fish meal.

In conclusion, it is observed that fish meal stored in nitrogen gas shows slightly beneficial effect over that stored in sealed tins, which itself is organoleptically and chemically in good condition for at least four months, and is fair up to the six months for which period it was observed.

TABLE I

Analytical data of fish meal

Initial values before storage:

Moisture %	..	9·305.
Protein %	..	41·96.
NaCl %	..	1·513.
Fat %	..	3·498.
Acid value	..	31·23.
T. V. B. mg/100. g.	..	48·12.
Bacterial count per gram	..	1,256 × 10^8.

Period	Nitrogen-packed tins					Sealed tins				
	Moisture	Fat.	Acid value	T. V. B. mg. %	Bacterial counts × 10^8/g	Moisture	Fat.	Acid value	T. V. B. mg. %	Bacterial counts × 10^8/g
Month										
1st	8·79	3·34	32·82	49·0	1,410	10·72	3·8	34·32	52·12	1,410
2nd	8·36	3·5	34·6	51·81	1,454	8·42	3·23	35·3	53·21	1,609
3rd	8·27	3·62	35·2	53·02	79,380	8·34	3·09	36·47	70·0	87,260
4th	8·10	3·02	36·9	81·4	29,150	8·35	3·06	41·09	89 6	29,300
5th	8·90	2·84	56·26	83·2	81,160	8·20	3·2	50·95	98·0	59,000
6th	9·22	2·95	42·41	73·6	6,396	9·14	2·1	55·81	92·0	8,925

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Japan and Japanese Agriculture*

By

M. B. V. NARASINGA RAO, B. A., B. SC., (Ag.)
Paddy Specialist.

Japan, the land of the 'Rising Sun' is also the land of bounteous crop harvests. The country is traversed by a central ridge of mountains quick flowing rivers, scenic lakes, deep valleys and thickly clothed forests with floods and typhoons, frosts and snows causing damage to crops. The area of the cultivated land has thus been limited by nature to 15 million acres, only a sixth of the total area. But from this limited area Japan is producing 85% to 90% of its food requirements for its 84 million people. The Japanese soils are not 'fertile' from the ordinary standards of soil analysis. Rice yields 4500 lb. of paddy and yield of wheat, barley, sweet potato, potato and vegetables are comparable with those in any part of the world. This high production is made possible through (1) Extensive use of artificial fertilizers (2) Conservation of all wastes (including human) for composting to serve as manure (3) Use of improved varieties of crop (4) Timely control of wide spread pests and diseases (5) Multiple cropping practices evolved through persistent trials and ingenious practices (6) Proper attention during all the stages of the crops.

There is a certain amount of "Decentralization" in the administration, research and habits of the people of the country. The country is divided into 46 Prefectures (excluding Hokkaido) with the National Government at the head. Administration of most of the services, including the Police of each prefecture vests in the elected and paid Governor and his assembly, who are also elected. Each of the Prefectures has an Agricultural Research Station, fully equipped and with adequate personnel in all the several branches—Chemistry, Plant improvement, Pathology, Agricultural Machinery etc. There are 8 regional stations under the National Government which tackle the problems pertaining to the region as a whole. Liasion between the several workers is maintained through frequent meetings of the Heads or Directors of most of these stations. Work pertaining to each subject e. g., rice, wheat, soil erosion fodder improvement, etc., is co-ordinated at the National level by a project leader. There are 19 such leaders in the Ministry of Agriculture and Forestry of the National Government.

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* A talk given under the auspices of the Madras Agricultural Students' Union on 5—10—1953.

The extension service in Japan is intensive. At the present momement there are 10,600 'Farm Advisers' one for each village. These have undergone 3 years course in an Agricultural High School, put in 2 years' training in a Prefectural Research Station and qualified by an examination conducted by a committee. The Farm Adviser has no cash transactions with him in any form and concerns himself with only advisory work for the overall improvement of production of the village. There are also 1,000 Home Improvement advisers, all women graduates in social service or economics, with 6 months training on a research station, to advise the farmers' families on the food habits, kitchen and home improvement, clothing habits, etc. Liason between research and extension is maintained by Subjectmatter Specialists, who are attached to each prefecture and spend considerable portion of their time on the Research Stations also.

There is a forecast service in the state with regard to weather and any impending incidence of major pests and diseases. Two hundred and sixty observatories (3rd class), with the important crops of the locality also laid out, are in charge of 2 or 3 assistants at each station and these record the weather elements as also any visible symptoms of pests and diseases and these are communicated to the Research Stations in each locality, who issue warnings through radios, press and pamphlets. It is exhilarating to find that 50% of the farm houses (there are 6 million farm-steads in Japan) own broadcast receives. Cheap electricity, which is developed from the flowing rivers and lakes is available almost throughout the country. A large number of fertilizer factories are spread throughout Japan and this simplifies transport and ensures timely supplies. It is reckoned that the consumer's price of the fertilizers is about 7% higher than the factory price. Japan is producing all her 2 million ton requirement of ammonium sulphate, 50,000 tons of urea and cyanamide. Her super phosphate requirements from rock phosphate are obtained from other countries. Ceresan and copper sulphate enough for her requirements, are now produced in her factories.

Mechanisation as we understand from the example of the West is absent in Japan. But the use of small scale machinery for efficiency and saving of fatigue is common in Japan. Hand tractors (3–5 H. P.), power-worked threshers ($\frac{1}{2}$ to 2 H. P.) and pedal threshers, compact rice hullers (1 to 2 H. P.), power sprayers and dusters, machines for processing rice straw into ropes, mats, hats, etc., are all now produced in Japan in various factories situated througout the country.

Literacy in Japan is probably the highest in the world. Education is free and compulsory for nine years (6 years primary and 3 secondary) for all boys and girls in Japan. After this period the road forks and High School education begins. There are Technical High Schools and General Purpose High Schools from this stage and the boys and girls choose the course depending upon their abilities and tastes. There are **700 Agricultural High Schools of 3 years' course** after which the student can take up the Agricultural College course or join a Research Station or go back to his land.

The whole of Japan may be deemed to be a large family of Co-operatives. The Japanese *have to help each other for mutual benefit.* At present there are more than 20,000 General Co-operatives in the country of which each village has an Agricultural Co-operative Society, which deals with all activities calculated to promote the social welfare of the village. Buying and selling of all farmers' agricultural needs and to some extent home needs, marketing his surplus produce, processing raw materials on a small scale, providing credit and encouraging thrift by atractive savings schemes etc., are all under their purview.

A word about the 'Japanese method' of rice culture about which there are diverse opinions. It may be at once said that the Japanese rice culture in essential is akin to any good culture of a crop but the important points of difference between it and our rice culture for instance, are the following. (1) The heavy manuring through mostly artificial fertilizers to supply 75–100 lb. nitrogen, 40—75 lb. P_2O_5 and 30–50 lb. K_2O. All the farmers use all the 3 ingredients, (only the quantities differ) over a basal dressing of 2,000 to 3,000 lb. of organic matter, 2). All the 8 million acres of rice are planted in regular rows, the spacing in the row and between rows depending upon the conditions, the normal spacing appears to be 10″ by 6″. This is made very easy by different 'markers' for line planting. (3) First weeding after 15 days of planting and then thorough inter-cultivation with a rotary inter-cultivator at least 3 times at intervals of 15 days and (4) Timely checking of wide spread of disease or pest by a co-operative campaign by all the farmers.

Research Note.

Birds Damage in Jowar

Birds that are commonly seen causing damage to cereal crops in this tract are parrots *(Psittacula eupatria* Linn.*)*, sparrows *(Passer domesticus* Linn.*)* yellow-throated wild sparrows *(Gymonorhis xanthocollis* Burton*)*; locally called "Kabbakki", crows *(Corvus splendens* Vieillot.*)*; black-headed bunting *(Emberiza melanocephala* Scopoli*)* and the Baya or the common weaver bird *(Ploceus philippinus* Linn.*)*

The loss in grain yield due to bird damage as estimated in eight improved cholam varieties raised on the Farm under large-scale bulk tests is given below. All the earheads in one of the plots in each variety were bagged with thin muslin bags soon after the flower emergence while the earheads in the corresponding plots were left unprotected. Bird scaring by adult manual labour was carried out commencing from the date of flowering till harvest time, from dawn to dusk.

S. No.	Variety	Acre yield in lb.		Loss of grain due to bird damage	
		Protected Area	Unprotected Area	Actual loss per acre	Loss in percentge
1.	M. 31–2	2084	1667	417	20·00
2.	M. 35–1— $\frac{6\text{–}8\text{–}4}{1\text{–}14}$	1745	1396	349	20·00
3.	P. B. 1R	1689	1351	338	20·44
4.	M, 35–1 $\frac{21\text{–}1}{1\text{–}12}$	1633	1306	327	20·02
5.	N. D. 15	1409	1127	282	20 01
6.	N. J. 26/152	1403	1122	281	20·03
7.	M–47–3*	2400	720	1680	70·00
8.	H–1**	3065	613	2452	80·00

(*) Early to flower and hence the heavy damage.
(**) Very late to flower and last to ripen and hence heavy damage.

It is seen from the above figures that the loss of grain caused by birds ranged from 20 to 80 percent. Bird damage was observed to be heavier in (i) Loose, panicled types than in compact ones, (ii) Type with gaping glumes than those with grains completely enclosed between the glumes, (iii) Grain colour; birds were definitely partial to white and pearly grains, next in order of preference come white and chalky types, closely followed by yellows while the reds were comparatively less affected. The activity of birds mentioned above is at the peak in the early hours of the morning and at

twilight. The mid-day being hot, they are rarely seen at this part of the day. In addition another class of nocturnal birds locally called as "*Korukunchi*" invade cholam fields in large numbers during nights and cause similar damage. The method at present largely employed by the cultivators to combat the damage is scaring birds day and night by employing adult scarers. On the Farm, various scaring methods like shooting by regular guns, creating noise by shooting blanks into the air or by working country guns, or putting mechanical devices worked with the aid of wind were tried without much success. The procedure of scaring birds by adult labour has come to stay inspite of its high cost, as the only effective remedy. Bird damage is greater in the tall-growing millets like cholam and cumbu where the birds hide easily without being seen. In the case of smaller millets like tenai etc. the birds can easily be seen and scared away more effectively.

Millet Assistants
Agricultural Research Station,
Siruguppa.

S. B. PRIYAVRATHA RAO.
D. V. NARASIMHA RAO.

EXTRACTS AND GLEANINGS

Dr. G. D. Ruehle reports successful control of *Anthracnose* on mango by the use of Zineb used in the bloom three times followed after the bloom by three application of copper A. Zineb was mixed at the rate of 1½ lbs. per 100 gallons of water. Captan was found to be as good as the usual Bordeaux mixture and resulted in much less scale build-up later. This was mixed at the rate of 3 lbs. per 100 gallons. Its compatibility with any proposed spreadours should be checked up. R. O. Nelson speaking on "use of plastic film in grafting of tropical and subtropical plants" said much improved results have been possible by using Vinylite plastic of 0·001 inch thick. It has been estimated that about July 1953, 30,000 boxes of mangoes would be exported to U. S. from Florida. To move a large mango tree, depending on the soil it is growing, it is best to cut back severely the top when the tap root is severed and the other is to root prune the tree several weeks before it is proposed to actually move it. It is also stated that a large collection of Chinese works on agriculture, botany and herbals are awaiting to be explored into by a Chinese scholar. These contain references to mango but no method of culture is given. A fellowship dinner of about 150 mango-maniacs, it seems, was held in the City of Miami and those that had failed to reserve a seat had to be turned away. (Florida Mango Forum News, Florida Subtropical Garden, 1953, August).

A very detailed account of the botany, histology, cytology and fibre technology of the plant *Abroma augusta* L. F. a member of the family *Sterculiaceæ* has been given. The fibre could be used as a substitute for jute. Its fibre length is from 0·12 inch in a young plant and 0·16—0·26 inch in an old one (Fine quality jute = 0·06—0·12 inch); length of staple = 4 to 8 ft. (jute 6 to 8 ft.). In its natural

characteristics, the fibre resembles *Hibiscus cannabinus* rather than jute. Fibre fairiy soft but less spinnable than true jute. Not strictly comparable with any grade of jute, but would come in with other recognised substitutes such as bimli jute *(Hibiscus cannabinus)*. (Publications de L' Institut National pour L' Etude Agronomique du Congo Belge. Ser. Techn. No. 42. 1953; pp. 110; bibl.)

ESTATE NEWS

Under the auspecies of the Madras Agricultural Students Union, Sri M. B. V. Narasinga Rao, Paddy Specialist who had been one of the party of Paddy Workers visiting Japan gave a talk on his "Impressions of Japan and Japanese Agriculture, with the Principal and ex-officio President of the Union, in the chair on 5—10—1953. He dealt with the geographical aspects of the country and its bearing on paddy cultivation, the enormous strides that the country has done in regard to several experimental aspects of investigations like control of light, temperature etc. An account of ingenious adaptations, simple agricultural machineries marketing of produce etc., were given. The account of the organisation of the Agricultural department, the Agricultural education starting from high school standards, and the co-operation of the farmers and their attitude to scientific methods were highly instructive. The meeting was attended by both the staff and students.

Agricultural College news: The several games teams of the College took part in a number of tournament and friendly matches. The number of matches won, lost and drawn respectively are: 5:1:—; cricket 5:2:1; football 3:3:2; hockey 4:4:—; table tennis —:1:—; volley ball 4:2:—.

The College took part in the local Rotary Club debating Contest. The College was awarded the rolling cup. The winners are: Rolling Cup awarded to Miss. Sukanya Bai; Individual merit cup to Mr. William, Odango Omamo.

The Social Service League of the College have started a night school for the poor boys near by. The strength of the school is now about 30. The league is also doing useful service to the Scavangers' colony adjoining the College Estate

Officers' Club: The Anniversary of the Officers' Club was celebrated on the 24th. and 25th instants. The function was largely attended. Entertainments, and games were highly enjoyed.

Weather Review — For the month of September 1953.

RAINFALL DATA

Division	Station	Total rainfall for the month in inches.	Departure fromnormal in inches	Total since 1st January in inches	Division	Station	Total rainfall for the month in inches.	Departure fromnormal in inches	Total since 1st January in inches
Orissa & Circars	Gopalpur	5·0	—2·5	41·1	Central Contd.	Vellore	9·9	+ 3·0	20·2
	Calingapatnam	5·6	—1·3	36·6		Gudiyatham*	2·9	— 1·0	15·8
	Visakhapatnam	5·4	—1·2	23·9		Salem	11·0	+ 4·9	37·1
	Arakuvalley*	..	..	..		Coimbatore (A. M. O.)*	1·3	— 0·3	21·6
	Anakapalle*	..	..	..		Coimbatore	1·5	— 0·1	20·7
	Samalkot*	4·6	—0·8	27·1		Tiruchirappalli	7·2	+ 3·2	22·6
	Kakinada	3·8	—2·4	22·3					
	Maruteru*	..	..	..	South	Nagapattinam	3·7	+ 0·4	14·6
	Masulipatnam	6·0	—0·4	28·5		Aduturai*	3·2	— 0·1	12·3
	Guntur*	..	..	..		Pattukottai*	1·0	— 2·3	12·6
	Agrl. College, Bapatla*	7·3	+0·6	20·4		Madurai	7·0	+ 2·3	27·6
						Pamban	0·6	— 0·5	6·3
	Agrl. College, Farm, Bapatla*	7·7	x	23·2		Koilpatti*	2·4	+ 0·5	12·6
						Palayamcottai	1·5	+ 0·3	10·6
	Rentachintala	7·4	+2·6	23·9		Ambasamudram*	0·4	— 0·4	14·8
Ceded Districts	Kurnool	9·5	+3·5	22·5	West Coast	Trivandrum	2·9	— 1·6	45·6
	Nandyal*	8·7	+2·4	22·3		Fort Cochin	4·9	— 2·8	84·6
	Hagari*	3·6	—1·7	11·3		Kozhikode	2·2	— 4·4	83·7
	Siruguppa*	6·8	+0·6	18·7		Pattambi*	1·8	— 4·4	63·9
	Bellary	4·5	—0·4	16·6		Taliparamba*	..	..	..
	Cuddapah	4·4	—1·6	12·7		Wynaad*	4·5	— 2·4	74·6
	Kodur*	..	..	..		Nileshwar*	4·3	— 6·3	108·4
	Anantapur	9·5	+3·2	20·1		Pilicode*	2·9	— 8·0	99·5
						Mangalore	5·8	— 3·6	104·5
Carnatic	Nellore	2·9	—1·6	20·1		Kankanady*	6·1	— 5·7	109·1
	Buchireddipalem*	2·8	—1·0	9·1	Mysore & Coorg	Chitaldrug	0·9	— 3·5	9·5
	Madras (Meenambakkam)	5·5	+0·8	12·3		Bangalore	7·8	+ 1·1	27·4
						Mysore	5·5	— 0·5	22·4
						Mercara	5·9	— 5·2	117·5
	Tirurkuppam*	5·3	—0·6	13·9	Hills	Kodaikanal	5·0	— 2·3	39·1
	Palur*	7·6	+2·9	20·8		Coonoor*	3·1	— 0·4	40·6
	Tindivanam*	4·5	—0·3	18·6		Ootacamund*	4·3	— 0·5	41·8
	Cuddalore	6·4	+1·2	19·9		Nanjanad*	7·3	+ 1·3	57·2
Central	Arogyavaram (Chittoor dt.)	6·7	+1·6	16·3					

Note :—

1. * Meteorological Stations of the Madras Agricultural Department.
2. @ Average of eight years data for Arakuvalley is given as normal.
3. Average of ten years' data is taken as normal.
4. X The Farm was started only in 1951.

Weather Review for September 1953

Unsettled conditions were observed in the west central Bay of Bengal and the adjoining north west Bay on the first day of the month due to the moving in of a low presssure wave from Burma into that region. Conditions continued to remain unsettled for six days till they concentrated into a shallow depression on 7-9-1953, centred at 08·30 hours I. S. T. near lat. 20°N and long. 88°E. This shallow depression weakened on the very next day, moved inland and lay as a weak low over coastal West Bengal and the adjoining areas and became unimportant on 9-9-1953. Under its influence rainfall was fairly widespread along the West Coast and occurred at a number of stations in coastal Andhradesa, Rayalaseema and Tamilnad during the first week of this month.

A shallow low pressure area appeared over Bihar and the adjoining areas on 11-9-1953. This persisted there upto 13-9-1953 and then moved eastwards till it became unimportant over East Pakistan and neighbourhood after two days. A well marked cyclonic circulation also persisted over southwest Bay of Bengal and the adioining Coromandal coast upto 10,000′ above sea level on 12-9-1953. Thunder-showers were fairly widespread in Tamilnad, Rayalaseema and Coastal Andhradesa on 3 days from 11th to 13th September 1953.

The monsoon practically withdrew from northwest India on 14-9-1953. A low pressure wave moved from north Andaman sea into the Central Bay of Bengal on 16-9-1953, and caused unsettled conditions in the north and the adjoining central Bay of Bengal, which moved inland as a low pressure wave across Sunderbans coast. Another low pressure wave moved into the east central Bay of Bengal on 20-9-1953 causing unsettled conditions in the central and adjcining Bay of Bengal which concentrated into a depression centred at 08·30 hours I. S. T. on 23-9-1953 near about lat. 16°N. long. 91°E. This deepened further into a cyclonic storm of small core on 26-9-1953 and crossed the coast near the Contai as a deep depression on the same night. This deep depression progressively weakened while moving northwest-wards and lay as a low pressure area over East Uttar Pradesh and the adjoining areas on the last day of the month. Yet another low pressure wave moved into the central Bay of Bengal from the east on 29-9-1953, and a cyclonic circulation existed over the central Bay from 3,000′ to 10,000′ above sea level on 30-9-1953. Thunder showers occurred at a number of places in Coastal Andhradesa and Tamilnad on 30-9-1953.

The noteworthy rainfalls for the month and the zonal rainfall have been furnished hereunder.

Noteworthy rainfalls for the month

Serial No.	Date	Name of Station	Rainfall for the past 24 hrs.
1	11—9—1953	Salem	3·4″
2	11—9—1953	Kallakurichi	2·6″
3	12—9—1953	Botanical Gardens, Ooty	2·5″
4	13—9—1953	Anantapur	4·0″
5	15—9—1953	Vellore	2·0″
6	17—9—1953	Tiruchirapalli	3·0″
7	20—9—1953	Madurai	3·7″

Serial No.	Date	Name of Station	Rainfall for the past 24 hrs.
8	21—9—1953	Arogyavaram	2·1″
9	do.	Nanjanad	2·4″
10	23—9—1953	Kurnool	2·0″
11	do.	Ongole	2·1″
12	30—9—1953	Mysore	2·1″

Zonal Rainfall

Sl. No.	Name of Zone	Rainfall for the month	Departure from normal	Remarks
1	Orissa and Circars	..	..	..
2	Ceded districts	6·72	+ 0·86	Above normal
3	Carnatic	5·00	+ 0·14	Just ,,
4	Central	5·79	+ 1·61	Above ,,
5	South	2·49	+ 0·03	Normal
6	West Coast	3·93	— 4·38	Far below normal
7	Mysore and Coorg	5·03	— 2·03	do.
8	Hills	4·93	— 0·48	Below ,,

A. S., C. B. M., & M. V. J.

Departmental Notifications

GAZETTED SERVICE

Postings and Transfers

Madras State

Names	From	To
Annaswami Iyer, A. K.	D. A. O.	Addl. D. A. O. Madurai
Brahmachari, K.	Asst. Entomologist on leave	Asst. Entomologist, Civil supplies, Coimbatore
Balasubramaniam, C. S.	Asst. Entomologist, Civil supplies, Coimbatore	Gazetted Asst. Ento. Coimbatore
Govindaswami, G. V.	Lec. in Myco., Bapatla	Lec. in Myco. Coimbatore
Kandaswami, M.	Lec. in Myco. Coimbatore	On leave

Name	From	To
Kachapeswara Iyer, S. S.	Dy. D. A. Coimbatore	Spl. Dy. D. A. Madras
Kanakaraj David, S.	Gazetted Asst. Lec. in Ento., Coimbatore	Reverted
Mohamad Obedulla Shah,	Dy. D. A.	Dy. D. A. Coimbatore
Mohmad Abbas, U. B.	D. A. O. Madurai	Spl. Officer for Rice, Visakapatnam
Mariakulandai, Dr. A.	Asst. in Chemistry, Coimbatore	Asst. Agrl. Chemist, Coimbatore
Natesa Iyer, K. V.	Spl. D. A. O. Madurai	D. A. O. Madurai
Palanivelu, T. S.	Asst. Agrl. Engineer, Mechanical	Asst. Agrl. Eng. Mechanical Groundnut Scheme, Coimbatore
Radhakrishnan, T.	Asst. Agrl. Eng. Civil	Asst. Agrl. Eng. soil conservation Scheme, Coimbatore
Raman Menon, K.	Spl. D. A. O. Salem	Spl. D. A. O. Madurai
Srinivasan, V.	Asst. in Pulses, Coimbatore	S. D. O. Vellore
Thirumalacharya, N. C.	S. D. O. Vellore	Spl. D. A. O. Salem
Andhra State:		
Bhujanga Rao, C.	Supdt. Wynad Colonisation Scheme	Fruit Specialist, Kodur
Chandrasekhara Sastry, V.	Asst. Lec. Mech. Eng. Bapatla	Lec. in Mech. Eng., Bapatla
Govindarao, P.	P. P. O. Myco. Bapatla	Agrl. Mycologist, Bapatla
Krishnamurthy, K.	Spl. A. D. Sugarcane, Peddapuram	Sugarcane Inspector, Visakapatnam
Krishnamurthy Rao, S.	Spl. A. D. Bellary	D. A. O. Vijayawada
Mohan Rao, K. R.	Asst. in Ento. Coimbatore	Lec. in Ento. Bapatla
Prakasam, P.	Asst. in Myco. A. R. S. Anakapalle	Lec. in Myco. Bapatla
Parthasarathy, A. V.	Asst. in Millets, Nandyal	Asst. Millet Specialist, Nandiyal
Ramachandran, C.	Asst. in Ento. Anakapalle	Gazetted Asst. Lec. in Ento. Bapatla.
Ramachandran, S.	Asst. in Millets, Ongole	S. D. O. Millets, Cuddapah
Ramakrishna Reddy, B.	P. A. to D. A. O. Kurnool	Asst. Marketing Officer, Cuddapah
Subramaniam, P.	Asst. Millet Specialist, Nandyal	Millet Specialist, Lam.
Seshagiri Rao, M.	Asst. Lec. Civil Eng. Bapatla	Lec. in Civil Eng. Bapatla
Suryanarayanamurthy, B.	Supdt. A. R. S. Hagari	Chilli Specialist, A. R. S. Lam
Srinivasa Rao, D.	Agrl. Instructor, Bapatla	Asst. Marketing Officer, Kakinada
Thirumalarao, W.	Asst. in Chemistry, Coimbatore	Asst. Chemist, Anakapalle
Veeramohan Rao, N.	Sugarcane Chemist, Anakapalle	Sugarcane Specialist, Anakapalle

SUBORDINATE SERVICE

Madras State

Names	From	To
Alagappa Pillai, S.	P. P. A. Myco. Tinnevelly	Spl. A. D. Melur
Adyantayya, N. R.	P. P. O. Myco. Coimbatore	On leave
Anantaraman, P. V.	Asst. in Paddy Coimbatore	Asst. in Chemistry, Coimbatore
Ekambaram	Supdt. Liaisen Farm Hospet	Reverted
Ethirajan, A.	A. D. Arni	A. D. Palur
Gajapathy, V.	F. M. Satyamangalam	A. D. Shiyali
Iyamperumal, S.	Cotton Asst. Koilpatty	Cotton Certification Inspector, Rajapalayam
John Chandramohan	A. R. S. Ambasamudram	Asst. in paddy, Coimbatore
Kannian, K.	Cotton Certification Officer, Rajapalayam	Asst. in Cotton, Coimbatore
Kuttisankaran, M. P.	A. A. D. Taliparamba	F. M. Kulitalai
Pandurangam, S. V.	S. D. A. Cuddalore	Spl. A. D. Cotton, Coimbatore
Ramachandran, M.	Marketing Asst. Coimbatore	Secretary, Tinnevelly Market Committee, Koilpatty
Radhakrishnan, T. V.	Cotton Asst. Srivaliputhoor	Cotton Certification Inspector, Rajapalayam
Sankarasubramaniam, T. K.	P. A. to D. A. O. Sattur	P. A. to D. A. O. Tinnevelly
Andhra State		
Bhaskara Rao, M. V.	P. A. to D. A. O. Elluru	A. D. Tadepallegudam
Bhaskara Rao, C.	A. R. S. Maruteru	Asst. in Paddy, Buchiredipalayam
Krishnamurthy, K.	Spl. A. D. Sugarcane, Peddapuram	P. A. to D. A. O. Srikakulam
Ramamohan Rao, A.	A. D. Tadepallegudam	P. A. to D. A. O. Elluru
Ramamohan Rao, K.	P. A. to D. A. O. Srikakulam	Spl A. D. Sugarcane, Peddapuram
Subramaniam, A.	P. A. to D. A. O. Kakinada	Spl. A. D. Samalkota
Srinivasa Rao, M.	A. D. Sulurpet	P. A. to D. A. O. Nellore
Shaik Hussain	P. A. to D. A. O. Nellore	A. D. Sulurpet
Syed Ibrahim	Supdt. A. R. S. Samalkot	Asst. in Paddy, Maruteru
Venkatareddy Naidu, K.	Spl. A. D. Samalkot	P. A. to D. A. O. Kakinada
Venkateswara Rao, M.	A. R. S. Buchireddipalayam	A. A. D. Ongole
Venugopal Reddy, P.	A. A. D. Pakala	Spl. A. D. Chandragiri

Madras State

Name	From	To
Sundaram Pillai, K.	P. A. to D. A. O. Tinnevelly	P. P. A. Myco. Tinnevelly
Sriraman, K.	Marketing Asst. Madras	Secretary, North Arcot Market Committee, Vellore
Samathuvam, K.	Asst. in O.S.S. Coimbatore	Asst. in Chemistry, Coimbatore
Thomas, K. C.	Addl. D. A. O. Madurai	Paddy Cum Millet Asst. Shoranur
Thirumaleswar Bhatt	Asst. in O. S. S. Coconut nursery Scheme, Nileshwar	S. D. A. Mangalore
Venkatakrishnan	D. A. O. Guntur	P. A. to D. A. O. Sattur
Venkateswaran, A. N.	Asst. in O. S. S. Coconut Nursery Scheme	Asst. in O.S.S. Main Station, Coimbatore
Veeraraghavan, V.	A. A. D. Walajah	A. D. Arni
Meenakshisundaram	Asst. Lec. in Agrl. Economics, Coimbatore	Marketing Asst. Madras